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## REMARKS

Claims 7-9 are pending herein. Claims 1-6 have been withdrawn from consideration by the PTO. Claims 7-9 have been amended for clarification purposes only. Attached hereto as page 9, pursuant to Rule 1.121(c)(1)(ii), is a marked-up version of the amended claims.

1. Applicants affirm the provisional election to prosecute claims 7-9. Claims 1-6 have been withdrawn from consideration as being drawn to a non-elected invention, and thus have been cancelled without prejudice or disclaimer. Applicants reserve the right under 35 USC §121 to file a divisional application for the non-elected claims.

2. Claims 7-9 were rejected under §103(a) over Nakamura in view of Ohmi et al. This rejection is respectfully traversed.

With reference to Fig. 2 of the present application, pending independent claim 7 recites, among other things, that at least one of the interior wall of reactor 11 and susceptor 13 is coated with an  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  film ( $a + b + c = 1$ ,  $a > 0$ ).

Applicants discovered that  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  particles tend to form on the interior wall of reactor 11 and susceptor 13 during MOCVD film formation. The  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  particles are displaced and deposited onto substrate 12, which is positioned on susceptor 13, thereby contaminating the film formed on substrate 12. These contaminants decrease the crystalline quality of the group III-V nitride film that is epitaxially grown on substrate 12 (specification page 4, paragraph [0016]).

Applicants discovered that by coating an  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  film on at least one of the interior wall of the reactor and/or the susceptor, contamination of substrate 12 could be prevented because  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  particles do not form on the interior wall of reactor 11 or on susceptor 13. As a result, the film is formed only from the reaction of the raw material gases supplied to the reaction chamber. Accordingly, contamination of the substrate (e.g., wafer)

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positioned on the susceptor can be prevented, which in turn, ensures better crystallinity of the epitaxially grown film. The prior art, discussed below, does not disclose or suggest that a film coating alone on any portion of the interior wall of the reactor or on the susceptor is capable of achieving the above-discussed benefits.

With reference to Fig. 7 of Nakamura, a susceptor 4, having a sapphire substrate 1 positioned thereon, is provided in a reactor chamber 6. A reaction gas blow tube 2 is provided to supply a reaction gas to a portion above the surface of substrate 1, in a direction parallel or slightly oblique to the substrate (column 7, lines 52-54). A sub-blow tube 3 is provided to blow a pressing gas, which is inert with respect to the reaction gas, toward the substrate to bring the reaction gas into contact with the surface of the substrate.

Nakamura recognizes that inner surfaces of reactors are prone to being contaminated by reaction gases. For example, with reference to Fig. 5 of Nakamura, Nakamura acknowledges that since the inner surfaces of inner and outer tubes, which form a reactor structure, are contaminated by the reaction gas, the inner and outer tubes cannot be successively used a plurality of times (column 3, lines 8-11). As a result of such contamination, Nakamura discloses that the entire reactor must be replaced after it is used only several times (column 3, lines 23-24).

To remedy the above-discussed contamination problem, Nakamura discloses that "the reaction gas blow tube need not be arranged above a substrate. Therefore, even when GaN deposited on the reaction gas blow tube is decomposed into [a] Ga metal, the Ga metal does not fall to adhere on the substrate. In addition, since the direction of the reaction gas is changed by the pressing gas, the Ga metal hardly reaches a substrate even when the reaction gas is blown parallel to the substrate" (column 4, lines 17-25). Accordingly, and as correctly

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recognized by the PTO, Nakamura does not disclose coating the interior wall of either the reactor or the susceptor with an  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film to prevent contamination of the wafer.

With reference to Fig. 1B of Ohmi, a wafer susceptor apparatus includes a heating supporter 1 having a dense coating film formed thereon, which can be an aluminum nitride film (column 6, line 4). Ohmi discloses that an impurity gas tends to invade the heating supporter during the manufacturing process of the heating supporter. The impurity gas is prone to being released during epitaxial film growth and pollutes the reaction chamber (column 1, lines 28-35). To remedy this problem, prior art heating supporters have been typically coated with a dense coating film with the hope that any impurity gas released by the heating supporter will not pass through the entire surface of the heating supporter (column 1, lines 23-28). Ohmi teaches that "[i]t is however difficult, with only this deposition method, [i.e., dense coating on the heating supporter surface] to completely prevent any impurity gas from being freed from the heating supporter with the aid of the dense coating film under high temperature conditions during the growth of an epitaxial film" (column 3, lines 14-19).

Ohmi provides a gas discharge part 3 in a portion of the heating supporter 1 to allow for the escape of any impurity gas which has built up in the heating supporter during the manufacturing process. The gas discharge part of the wafer susceptor is provided at a location downstream of the gas flow used in the film formation process. This downstream location prevents impurities released from the gas discharge part from being absorbed into the wafer support part when the susceptor is degassed in an atmosphere of purified gas before film formation (column 4, lines 33-40).

The PTO is apparently arguing that skilled artisans would have been motivated to employ "an AlN coating [as disclosed in Ohmi] over a susceptor [as disclosed in Nakamura] so as to prevent any impurity gas from being released from the susceptor during subsequent

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heating" (see page 3 of the Office Action). Applicants respectfully disagree with the PTO's position because Ohmi discloses that such a dense AlN coating, by itself, will not function to completely prevent the escape of impurity gas from the susceptor during epitaxial film growth (see column 3, lines 14-19 of Ohmi). As such, it would not have been obvious, based on the above-cited disclosure in Ohmi, to provide a coating on Nakamura's susceptor to prevent the release of impurity gas from the susceptor. Again, Ohmi requires the use of gas discharge part 3, in addition to coating the surface of the susceptor with a dense film, to blow impurity gases away from the wafer support part.

Moreover, neither Nakamura nor Ohmi disclose coating an interior wall of the reactor with a film. As discussed above, both Nakamura and Ohmi disclose the use of certain parts (e.g., gas blow tubes 2 and 3 and discharge part 3) to prevent contaminants from reaching the wafer support substrate. Again, Nakamura recognizes the problem of reaction gas contaminants adhering to the inner surface of reaction chamber walls, but teaches that pressing and reaction gases are flown in different directions over the substrate to prevent contaminants from reaching the substrate.

Furthermore, Applicants respectfully submit that there is no disclosure in the applied art references that would have caused skilled artisans to believe that by providing Ohmi's film coating on an interior wall of Nakamura's reactor, the poor anti-contaminate characteristics of Ohmi's dense coating would be remedied. Again, Ohmi discloses that the dense coating supplied on the susceptor surface does not function to completely prevent contamination of the reactor.

In view of all of the foregoing, reconsideration and withdrawal of the §103(a) rejection are respectfully requested.

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If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,



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A METHOD FOR FABRICATING A III-V NITRIDE FILM  
AND AN APPARATUS FOR FABRICATING THE SAME

Background of the invention

(1) Field of the invention

[0001] This invention relates to a method to epitaxially grow a Group III-V nitride film, particularly  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  ( $x+y+z=1$ ) film on a given substrate by a Metal Organic Chemical Vapor Deposition (MOCVD) method and an apparatus used when performing for the same method.

(2) Related Art Statement

[0002] In opto-electronic devices such as light-emitting diodes, laser diodes or photodiodes, it is proposed that III-V nitride films having their compositions of  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  ( $x+y+z=1$ ) is are epitaxially grown on a given substrate made of sapphire single crystal, for example. Up to now, the epitaxial growth of the  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film has been performed by a MOCVD method or recently, a Hydride Vapor Phase Epitaxy (HVPE) method.

[0003] In the case of making a GaN film by a HVPE method, first of all, a substrate made of sapphire single crystal is set into a reactor in which a gallium metallic material is charged. Then, a hydrochloric acid gas is introduced into the reactor and reacted with the gallium metallic material, to generate a hydrochloric gallium gas. Then, an ammonia gas is introduced into the reactor and reacted with the hydrochloric gallium gas, to deposit and fabricate the GaN film on

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the substrate. The HVPE method has a higher film growth rate than a MOCVD method or a MOVPE method. For example, in the MOVPE method, a GaN film can be epitaxially grown typically at only several  $\mu\text{m}/\text{hour}$ , but in the HVPE method, the GaN film can be epitaxially grown typically at several hundreds  $\mu\text{m}/\text{hour}$ . Therefore, the HVPE method ~~has its advantage in forming advantageously forms~~ a thicker III-V nitride film.

[0004] However, a good quality  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film can not be provided by the HVPE method, and the fluctuation in thickness on the same substrate may be increased. On the other hand, it takes ~~much~~ a large amount of time to form the  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film by the MOVPE method, and thus, the fabrication cost of the  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film rises.

[0005] In the case of making an  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  ( $x+y+z=1$ ) film by a MOCVD method, a given substrate is set and held on a susceptor installed in a reactor, and is heated to a predetermined temperature by a heater. Then, a trimethylaluminum gas, a trimethylgallium gas, a trimethylindium gas or the like as III raw material gases are introduced with a carrier gas composed of a hydrogen gas or a nitrogen gas into the reactor. On the other hand, an ammonia gas is used as a V raw material gas and is introduced with a carrier gas composed of a hydrogen gas or a nitrogen gas into the reactor. Then, the III raw material gases and the V raw material gas react with one another~~are reacted~~, to deposit and form the  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film on the substrate. As the  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film, an aluminum nitride film, a gallium nitride film, an indium nitride film, an aluminum-gallium nitride film, an aluminum-indium nitride film and a gallium-indium nitride film are exemplified.

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[0006] In the above conventional method such as a MOCVD method, if the reaction between the III raw material gases and the V raw material gas is created on the wall surfaces of the reactor, the film-forming efficiency is degraded, and thus, the film growth rate is decreased. In the past, therefore, the raw material gases are cooled down at their introduction into the reactor, or the interior walls of the reactor are partially cooled down.

[0007] On the other hand, the ammonia gas, which, as explained above, is used as the V raw material gas, exhibits ~~its~~ intensive corrosion ~~property~~ properties. Therefore, the heated parts of the interior wall of the reactor may be coated by a protective layer made of SiC, p-BN, TaCx, NbNx, etc., so as to prevent the corrosion of the interior wall. In this case, if the reaction between the III raw material gases and the V raw material gas is created on the wall surfaces of the reactor, the resulting  $\text{Al}_p\text{Ga}_q\text{In}_r\text{N}$  ( $p+q+r=1$ ) compound is not adequately deposited on the protective layer, but, rather, is likely to drop off of the protective layer as contaminant particles.

[0008] Particularly, at the highly heated parts of the protective layer, more particles composed of the  $\text{Al}_p\text{Ga}_q\text{In}_r\text{N}$  compound are created through the gas phase reaction between the III raw material gases and the V raw material gas due to the catalytic effect of the interior wall of the reactor. In the case of using a trimethylaluminum gas as one of the III raw material gases for making an AlN film or an Al-rich  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  ( $x+y+z=1$ ,  $x>0.5$ ) film, many particles are easily created due to the higher reactivity of the trimethylaluminum gas.

[0009] The resulting particles are ~~drop off from and~~ displaced from the protective layer, as mentioned above, and are blown off by the raw material gases or the carrier gas and deposited

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onto a substrate. In this case, the quality of the resulting  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film, particularly an AlN film or an Al-rich  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film is deteriorated due to the deposited particles.

[0010] In addition, since the substrate on which the  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film is formed is heated through a susceptor, which is initially heated with a heater, the surface temperature of the susceptor is raised to higher temperature of 1000°C or ~~even than more~~ versus that of the substrate temperature, ~~so that more~~ Consequently, particles composed of the  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  compound are more easily created on the surface of the susceptor. Then, the created particles are deposited on the substrate, and thus, the quality of the resulting  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film is deteriorated.

[0011] Fig. 1A is a conceptual view showing the film quality of an AlN film formed on a substrate made of a 3-inch wafer using a new susceptor. The quality deterioration of the AlN film is designated by the hatched region at the periphery of the substrate. As shown in Fig. 1A, the quality of the AlN film is remarkably deteriorated by using the new susceptor configuration described above, which is due to ~~the~~ contaminant particle deposition on the epitaxially grown  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film.

[0012] Moreover, when using such a large substrate as large as a 3-inch wafer ~~so as to~~ reduce the fabrication cost, the quality deterioration of the resulting  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film becomes remarkable due to more particles at the periphery of the substrate.

#### Summary of the Invention

[0013] It is an object of the present invention to work out the above conventional problems, and thus, to provide a method and an apparatus for epitaxially growing a good quality

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Al<sub>x</sub>Ga<sub>y</sub>In<sub>z</sub>N film ( $x+y+z=1$ ) by a MOCVD method.

[0014] In order to achieve the above object, this invention relates to ~~Aa~~ method for fabricating a Group III-V nitride film, including the steps of preparing a substrate onto a susceptor in a reactor, and heating the substrate to a predetermined temperature, ~~coating a~~an Al<sub>a</sub>Ga<sub>b</sub>In<sub>c</sub>N ( $a+b+c=1$ ,  $a>0$ ) film coating is formed on an interior portion of ~~athe~~ reactor, which is heated to about 1000°C or moreover through the heating for the substrate, ~~and introducing a~~a Group III raw material gas and a Group V raw material gas are introduced with a carrier gas, onto the substrate prepared in the reactor, and thus, ~~fabricating an~~ Al<sub>x</sub>Ga<sub>y</sub>In<sub>z</sub>N ( $x+y+z=1$ ) film is fabricated by a MOCVD method.

[0015] The coated Al<sub>a</sub>Ga<sub>b</sub>In<sub>c</sub>N ( $a+b+c=1$ ,  $a>0$ ) film includes unavoidable elements such as oxygen-element, silicon-element, magnesium-element and ~~another~~other elements ~~containing~~contained in the interior wall of the reactor by several %. Moreover, the Al<sub>a</sub>Ga<sub>b</sub>In<sub>c</sub>N film is not required to have a uniform composition over the total thickness, but may have a continuously or stepwisely inclined composition or ~~ana~~ multi-layered structure composed of plural films having their respective different compositions.

[0016] In a preferred embodiment of the present invention, an Al<sub>a</sub>Ga<sub>b</sub>In<sub>c</sub>N ( $a+b+c=1$ ,  $a>0$ ) film is coated on the susceptor, ~~to~~which holds the substrate. In the case of making a III-V nitride film by a MOCVD method, as mentioned above, the substrate is heated to around 1000°C, and thus, the surface of the susceptor is heated to 1000°C or moreover. Therefore, more particles composed of the Al<sub>p</sub>Ga<sub>q</sub>In<sub>r</sub>N ( $p+q+r=1$ ) compound isare likely to be created and deposited on

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the susceptor. However, if the susceptor is coated with the  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  film, the  $\text{AlpGaqlnrN}$  compound is deposited directly on the  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  film on the susceptor, and thus, the particles are not created and deposited on the substrate. As a result, the resulting  $\text{AlxGayInzN}$  film can have itsa desirable quality.

[0017] Herein, the particles means not only "particles having diameter of more than  $0.1\ \mu\text{m}$ ", but also "much smaller-scale intermediate products like polymers made from III raw materials, including, especially, aluminum and Group V raw materials."

[0018] The fabricating method of the present invention may be preferably usable in forming an Al-rich  $\text{AlxGayInzN}$  ( $x+y+z=1$ ,  $x>0.5$ ) film or an AlN film by introducing into the reactor mucha relatively large amount of trimethylaluminum gas with an ammonia gas.

[0019] Particularly, in the case of making the Al-rich  $\text{AlxGayInzN}$  film or the AlN film, the  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  film to be formed on the interior wall of the reactor and/or the susceptor includes a relatively large amount of Al element, preferably 50 atomic percentages or moreover ( $a>0.5$ ), more preferably 100 atomic percentages ( $a=1.0$ , that is, an AlN film). In this case, the Al-rich  $\text{AlpGaqlnrN}$  compound is efficiently deposited on the Al-rich  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  film coated on the susceptor and/or the interior wall of the reactor, and thus, the contaminant particles composed of the Al-rich  $\text{AlpGaqlnrN}$  compound are not almost created substantially eliminated.

[0020] This invention also relates to an apparatus for fabricating a Group III-V nitride film by a MOCVD method, including a reactor in which the MOCVD reaction between a III raw material gas and a V raw material gas is generated, aA susceptor to holds a substrate thereonand

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is installed in the reactor, a A heater is used to heat the substrate to a predetermined temperature via the susceptor, a At least one of the interior wall of the reactor and the susceptor is coated with an  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  ( $a+b+c=1$ ,  $a>0$ ) film, which is heated to  $1000^\circ\text{C}$  or moreover.

[0021] In the fabricating apparatus of the present invention, ~~the~~ the interior wall of the reactor and/or the susceptor is preferably coated with an Al-rich  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film or an AlN film when an Al-rich  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film or an AlN film is made by a MOCVD method using a III raw material gas such as a trimethylaluminum gas and a V raw material gas such as an ammonia gas, as mentioned above. Therefore, the fabricating method of the present invention may be preferably usable in forming an Al-rich  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  ( $x+y+z=1$ ,  $x>0.5$ ) film or an AlN film by introducing into the reactor a relatively large ~~much~~ amount of trimethylaluminum gas with an ammonia gas.

#### Brief Description of the Drawings

For better understanding of the present invention, reference is made to the attached drawings, wherein:

Fig. 1A is a conceptual view showing the film quality of an AlN film formed on a substrate made of a 3-inch wafer, according to the present invention;

Fig. 1B is a conceptual view showing the film quality of an AlN film, according to the present invention;

Fig. 2 is a cross sectional view diagrammatically showing the structure of a fabricating apparatus for a III-V nitride film according to the present invention;

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Fig. 3 is a cross sectional view showing the susceptor of the fabricating apparatus;  
and

Fig. 4 is a cross sectional view showing the susceptor of another fabricating  
apparatus according to the present invention.

#### Description of the Preferred Embodiments

[0022] Fig. 2 is a cross sectional view diagrammatically showing the structure of a  
fabricating apparatus for a III-V nitride film according to the present invention. In Fig. 2, the  
fabricating apparatus includes a reactor 11 made of quartz or stainless, a susceptor 13 at the center  
in the lower side of the reactor and a heater 14 under the susceptor 13. A substrate 12 made of,  
e.g., sapphire single crystal, is set horizontally on the susceptor and heated to a predetermined  
temperature with the heater. Although, in Fig. 2, the substrate is held on the upper surface of the  
susceptor, it may be held on the lower surface.

[0023] At the right side of the reactor 11 are provided gas inlets 15-17 to introduce raw  
material gases with a carrier gas. In the case of making an AlN film, for example, a  
trimethylaluminum gas is introduced with a hydrogen carrier gas from the first gas inlet 15, and  
an ammonia gas is introduced from the second gas inlet 16. Then, a carrier gas composed of a  
hydrogen gas or a nitrogen gas is introduced from the third gas inlet 17. The introduced  
trimethylaluminum gas and the introduced ammonia gas are also introduced into the center  
region of the reactor through separated guiding tubes 18 and 19, respectively. In this case, the  
raw material gases are effectively supplied onto the substrate 12, and not supplied in the remote

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region from the substrate 12. The introduced raw material gases are consumed by a MOCVD reaction on the substrate, and the remaining raw material gases are discharged from gas outlet 20 provided at the left side of the reactor 11.

[0024] In the case of making an AlN film, the substrate 12 is heated to around 1000°C, for example by the heater 14. In this case, the surface temperature of the susceptor 13 is raised to 1000°C or moreover. Therefore, the raw material gases are likely to be chemically reacted on the susceptor, to create particles composed of the AlN<sub>x</sub> compound. The particles are blown off by the raw material gases and the carrier gases and deposited on the substrate 12, to deteriorate the quality of the Al<sub>x</sub>Ga<sub>y</sub>In<sub>z</sub>N film, for example, an AlN film. Therefore, as shown in Fig. 3, for example, an AlN film 21 is coated in a thickness of 1 μm on the top surface and the side surfaces of the susceptor 13. In this case, the AlN<sub>x</sub> compound is deposited on the coated AlN film 21, and thus, contaminant particles composed of the AlN<sub>x</sub> compound are substantially eliminated~~not almost created~~. As a result, the resulting AlN film is not affected by the particles, and can have its desirable quality over ~~the almost~~substantially the entire main surface of the substrate, including the periphery thereof. Accordingly, the fabricating total cost of the AlN film can be reduced.

[0025] Although the present invention was described in detail with reference to the above example, this invention is not limited to the above disclosure and every kind of variations and modifications may be made without departing from the spirit and scope of the present invention.

[0026] For example, the AlN film 21 may be coated on the interior walls of the reactor and/or another instrument installed in the reactor, which are heated to higher temperature of

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1000°C or moreover, instead of providing a coating over the susceptor 13. ~~Then, besides~~In addition to the AlN film, another other AlGaInN ( $a+b+c=1$ ,  $a>0$ ) film or AlGaInN ( $a+b+c=1$ ,  $a>0.5$ ) film coatings may be employed~~coated~~.

[0027] The substrate 12 may be made of, instead of the sapphire single crystal, oxide single crystal such as ZnO single crystal, LiAlO<sub>2</sub> single crystal, LiGaO<sub>2</sub> single crystal, MgAl<sub>2</sub>O<sub>4</sub> single crystal, or MgO single crystal, IV single crystal or IV-IV single crystal such as Si single crystal or SiC single crystal, III-V single crystal such as GaAs single crystal, AlN single crystal, GaN single crystal or AlGaInN single crystal, and boride single crystal such as ZrB<sub>2</sub>. Moreover, the substrate 12 may be composed of an epitaxial substrate having such a single crystal as mentioned above as a base material and a given epitaxial film formed on the base material.

[0028] The substrate 12 may be set in a grooved portion 13a formed at the plane main surface of the susceptor 13 as shown in Fig. 4, instead of being set directly on the plane main surface of the susceptor 13. In this case, for not disturbing the raw material gas flow on the substrate 12, it is desired that the grooved portion is formed so that the surface level of the substrate 12 set into the grooved portion can be the same as the surface level of the coated AlN film 21. Moreover, the AlN film 21 may not be coated at the connection between the substrate 12 and the susceptor 13 and/or the side surfaces of the susceptor 13 to which the raw material gases are not directly contacted.

[0029] As mentioned above, according to the fabricating method and the fabricating apparatus for a III-V nitride film of the present invention, an AlGaInN ( $a+b+c=1$ ,  $a>0$ ) film,

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particularly an Al-rich  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  ( $a+b+c=1$ ,  $a>0.5$ ) film, and more particularly an Al film, is coated on an interior portion of the reactor which is heated to  $1000^\circ\text{C}$  or moreover. Therefore, the  $\text{Al}_p\text{Ga}_q\text{In}_r\text{N}$  ( $p+q+r=1$ ) compound generated through the reaction of the raw material gases is deposited on the coated film, and thus, contaminant particles made of the  $\text{Al}_p\text{Ga}_q\text{In}_r\text{N}$  compound are ~~not almost created~~ substantially eliminated. ~~As a result~~ Accordingly, the resulting  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  film is not affected by the contaminant particles, and can have its desirable film quality. In addition, the interior portion, including the interior wall of the reactor, is not almost substantially corroded by an ammonia gas as a V raw material gas because the coated film functions as an anti-corrosive film, so that the durability of the whole fabricating apparatus can be ~~developed~~ enhanced.

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7. (Amended) An apparatus for fabricating a Group III-V nitride film by a MOCVD method, comprising:

a reactor in which the MOCVD-reaction between a Group III raw material gas and a Group V material gas is generated;

a susceptor to hold a substrate thereon installed in the reactor; and

a heater to heat the substrate to a predetermined temperature via the susceptor,

wherein

at least one of the interior wall of the reactor and the susceptor is coated with an  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$ - $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  ( $a+b+c=1$ ,  $a>0$ ) film, which is heated to a temperature of 1000°C or more.

8. (Amended) An ~~fabricating~~ apparatus as defined in claim 7, wherein the  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$ - $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  ( $a+b+c=1$ ,  $a>0$ ) film includes at least 50 atomic percentages or over of Al element ( $a>0.5$ ) with respect to all of the Group III elements of the Periodic Table that are present in the film.

9. (Amended) An ~~fabricating~~ apparatus as defined in claim 8, wherein the  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$ - $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  ( $a+b+c=1$ ,  $a>0$ ) film is ~~composed of an AlN film.~~

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Amended claims

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Appl'n No.: 10/004,345

Abstract

At least one of the interior wall of a reactor and a susceptor installed in the reactor is coated with an  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  ( $a+b+c=1$ ,  $a>0$ ) film, which is heated to about  $1000^\circ\text{C}$  or ~~over~~more when a substrate is heated to a predetermined temperature so as to generate the ~~the~~ MOCVD reaction between a Group III raw material gas and a Group V raw material gas. Therefore, ~~the~~  $\text{Al}_p\text{Ga}_q\text{In}_r\text{N}$  ( $p+q+r=1$ ) compound generated from the raw material gases is deposited on the coated  $\text{Al}_a\text{Ga}_b\text{In}_c\text{N}$  ( $a+b+c=1$ ,  $a>0$ ) film, and thus, contaminant particles composed of the  $\text{Al}_p\text{Ga}_q\text{In}_r\text{N}$  compound are substantially decreased~~are not almost created~~. As a result, the ~~resulting~~ epitaxially grown  $\text{Al}_x\text{Ga}_y\text{In}_z\text{N}$  ( $x+y+z=1$ ) film is not affected by the contaminant particles, and can have its ~~a desirable~~desired crystalline quality.

VERSION WITH MARKINGS TO SHOW CHANGES MADE  
Amended abstract